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Spray-occasions determined from Meteorological Data during the 1980-81 season at 15 stations in the U.K. and comparison with 1971-80

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Summary

Criteria for determining spray-occasions from meteorological data have been developed over the last few years. This paper presents the figures for the 1980-81 season and compares them with average values experienced during 1971-80 at 15 stations.

The average values and conditions in the third worst year for each month of a 10-year sample are given based on criteria considered appropriate to Low Ground Pressure vehicles equipped with conventional spraying equipment. Values are also given of the average increase in the number of spray occasions by using Low Ground Pressure vehicles (rather than conventional vehicles), and spraying equipment capable of being used in slightly stronger winds.

1. Introduction

In the 16th and 17th Herbicide Reviews, Dr. R. Adams developed criteria based on meteorological data which enables one to compare and contrast spraying opportunities at different places and in different seasons. The reader should refer to the 16th (1979) Review for a discussion on the choice of criteria and applications of the technique.

This year the analysis has been extended to include data from 15 stations and to provide average values of the number of spray occasions as well as an indication of the number of occasions likely to be experienced in the worst years.

2. Criteria

The criteria used to identify occasions likely to be suitable for spraying are unchanged from those used for 1979/80.

For Low Ground Pressure (LGP) vehicles the count of 'spray occasions' is based on the following criteria:

a) Daylight, but not earlier than 0600 h or later than 2000 h GMT.

b) No precipitation at the time of observation, or in the preceding hour.

c) Windspeed less than or equal to 9 kts (about 10 mph) at the meteorological observing height of 10m.

d) Air Temperature greater than 1.0°C during spraying.

e) Air temperature greater than 7.0°C at some time during the day.

f) With the exception of (e) all criteria must be satisfied simultaneously for at least 5 successive hours. Thus any period of 5-9 hours would be classed as one suitable occasion.

If conventional vehicles are considered a further criterion is introduced.

g) Days when the Soil Moisture Deficit (SMD) is less than 5 mm (bare soil model) are excluded.

There may also be sprayers which can safely operate in slightly higher winds. These will be referred to as **Higher Windspeed sprayers.** For these, **criterion** (c) is relaxed so that windspeeds up to (and including) 12 knots (or 14 mph) are included.

It must be remembered that the criteria were developed as a basis for comparative analysis and cannot be regarded as suitable for all types of equipment, chemical, soil, crop etc. They are also based on the conditions at about the time of spraying and no consideration is given as to the condition or growth stage of the crop, weed, fungus, pest etc. to which the spray is to be applied.

3. Stations

Fifteen stations (covering most of the United Kingdom) have been used in the analysis. They were selected mainly according to the availability of suitable computerised meteorological records for the period since 1971. Their locations are shown in figure 1. Some stations may not be entirely appropriate for the representation of conditions in agricultural crops over a very large area. However, if certain of the stations are excluded (eg. Aberporth, which is on an exposed cliff top location by Cardigan Bay) no alternative could be chosen.

4. Average number of spray occasions for 1971-80

Statistics have been computed at each station for 1971-80. Ideally averages of this sort should be based on a somewhat longer period than 10 years but not enough data are yet available to do this at all stations.

The average number of spray occasions in each month using the criteria appropriate to LGP vehicles is given in table 1. It can be seen that there is a general trend for the number of occasions to increase from north and west to south and east with higher values inland than near coasts. There is not always a clear geographical pattern suggesting that individual stations are probably influenced by their local surroundings. Perhaps the most notable feature is the relatively early reduction in spray occasions in Scotland, N. Ireland and West Wales from September in comparison with other stations. If it is assumed that 10 occasions per month represents the limit below which the number of spray occasions is likely to present problems to the farmer then on average problems will be encounted between November and February.

For planning purposes (eg. when proposing spray programmes) it is probably of less use to plan for average conditions than for a poor year. Table 2 gives the number of spray occasions experienced in the third worst year (lower quart) of each month during 1971-80. Here, problems could be encountered any month between November and March but low values are also found in October and April at some stations (mainly in the north and west). Examination of figures for the worst months of the period shows that values less than 10 occur at some stations in all months except August. The most noteworthy values were in July 1974 with 7 occasions at Rhoose, and 9 at Aldergrove, Shawbury and Honington.

Some idea of the advantage of using LGP vehicles over Conventional vehicles can be seen in table 3. This gives the average number of days gained over all stations. It is clear that the greatest advantage is gained in February, March and October; of course this will not be true every year. For Conventional vehicles there are on average almost no spray occasions available between November and February. The gain for LGP vehicles also equipped with Higher Windspeed Sprayers is shown in table 4. Advantages are experienced on average between April and October - months in which LGP vehicles usually have more than 10 occasions anyway.

5. Spray Occasions 1980-81

As a general comment is is notable that June 1980 to June 1981 is generally among the poorer years for spraying since at least 1971.

a. Conventional Vehicles

The numbers of spray occasions are given in table 5.

i. Summer 1980

June was relatively bad compared with average values for 1971-80 (except at Turnhouse, Honington and Stansted) and very bad at several stations (particularly so at Aldergrove and Leeming). The range of values is also very large and ranges from 0 at Aldergrove to 30 at Stansted.

July was only little different. August was a little better and with the generally higher values experienced on average nowhere should have experienced problems.

ii. Autumn 1980

September was relatively poor except in the South East and difficulties should certainly have been experienced at places in the north. October again had relatively low values and with 7 or fewer occasions at almost all stations the pressure to use any suitable spray day may have been widespread.

iii. Winter 1980–81

As is usual there were almost no occasions from November to February.

iv. Spring 1981

In March conditions had improved only marginally at a few stations. It is worth noting that the highest values recorded are at the two most northerly stations - Kinloss with 6 occasions and Turnhouse with 3. Values for April are near average and rather above in Scotland. Except in Scotland the numbers of occasions in May were well below average and 6 stations have values below 10.

Limited data have been processed for June but suggest that, yet again, conditions were somewhat below average.

b. Low Ground Pressure Vehicles

These vehicles generally benefitted from conditions in October and January with around 5 or more extra occasions over conventional vehicles per month. Some stations benefitted in other months. The numbers of spray occasions are given in table 6 and the average gain for stations over Conventional vehicles is given in table 7.

Two unusual events are worthy of note. In June 1980 half of the stations gained an extra 3 to 9 occasions and in May 1981 Rhoose, Waddington and Stansted gained 5 or more occasions due to the wet soil conditions in these months.

c. Higher Windspeed Sprayers

These systems generally benefit over Low Ground Pressure vehicles equipped with Conventional sprayers between April and October. This seems to have been generally true in the 1980–81 season. The average gain over all stations is given in table 8.

6. Conclusions

The analysis presented above demonstrates that the advantages, in terms of an increase in spray occasions, of using Low Ground Pressure Vehicles are experienced in winter and more particularly spring and autumn. It also shows that a sprayer capable of operating under slightly stronger wind speeds gains the most additional benefit between late spring and early autumn.

The figures for 1980–81 provide an objective measure of the character of the season and can be compared with the averages for 1971–80 and indicate those months and areas of the country in which problems are most likely.

to have arisen. At many stations the number of spray-occasions each month between June 1980 and May 1981 (except January and April) seems to have been below average for 1971-80.

Acknowledgement

The authors acknowledge the previous work of Dr. R. Adams who instigated this work and developed the criteria and strategy of analysis.

FIGURE 1.

STATIONS USED
FOR ANALYSIS

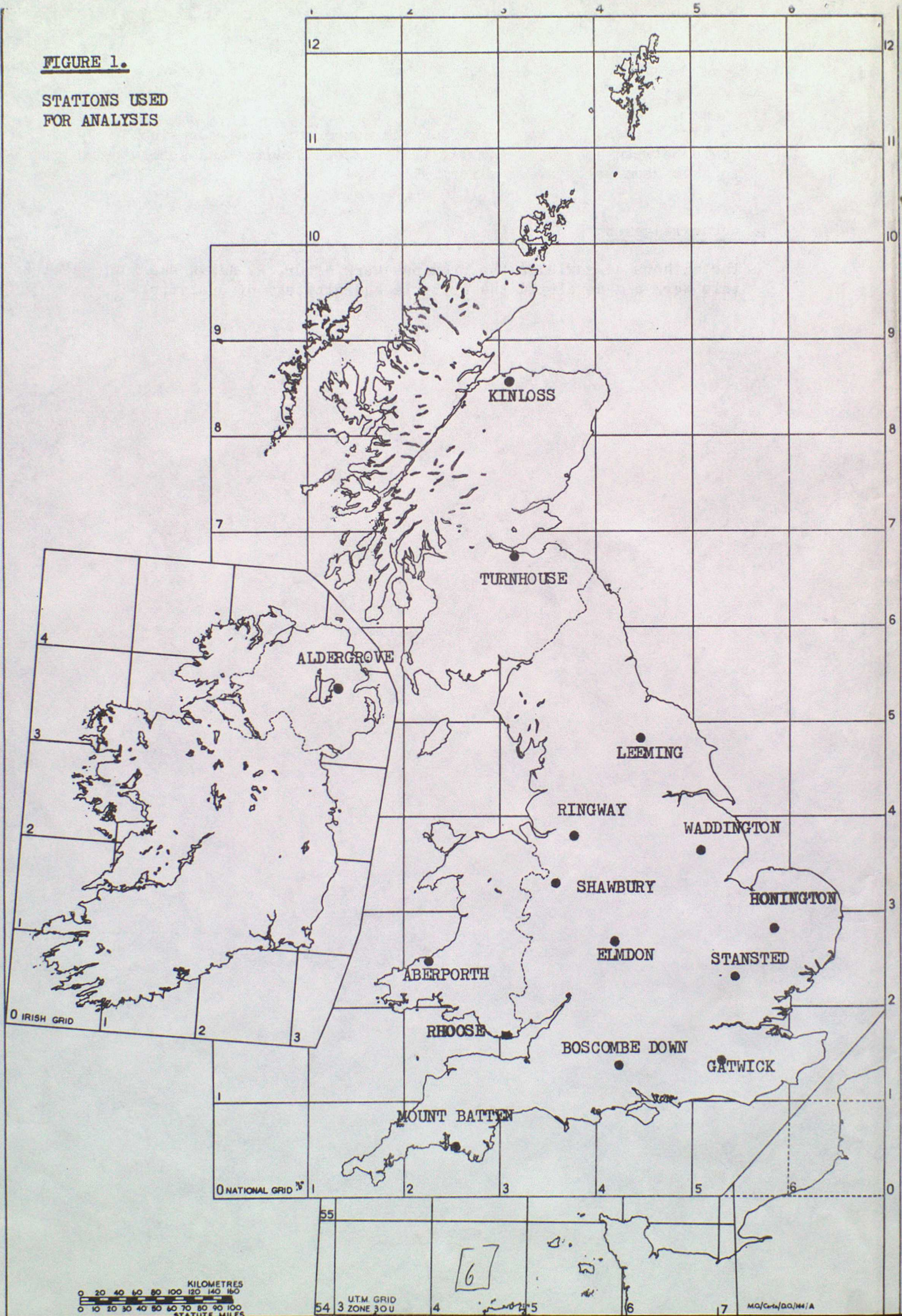

Table 1 - Average number of spray occasions (1971-80):
Low Ground Pressure vehicles

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
KINLOSS	1	6	8	16	16	16	19	23	13	12	4	2	134
TURNHOUSE	1	5	9	17	18	17	23	25	16	15	4	2	151
ALDERGROVE	2	6	9	20	19	20	22	25	16	13	4	2	141
ABERPORTH	1	4	7	18	22	24	25	25	16	8	2	1	153
RHOOSE	2	6	11	18	19	20	23	24	20	14	7	2	167
MOUNT BATTEN	4	7	11	15	19	20	24	24	20	12	7	5	169
LEEMING	3	5	9	17	19	19	25	28	19	17	5	2	168
RINGWAY	2	7	11	17	19	22	25	27	22	17	4	3	175
SHAWBURY	3	8	12	19	24	25	28	32	24	20	7	4	206
ELMDON	2	6	11	16	19	23	27	30	24	20	6	3	188
WADDINGTON	1	5	9	17	18	22	29	27	20	15	3	1	168
HONINGTON	1	6	11	14	17	22	24	27	22	18	5	1	168
STANSTED	3	6	13	17	20	27	28	29	26	19	7	4	199
BOSCOMBE DOWN	2	5	10	13	17	21	25	26	20	15	7	3	165
GATWICK	3	8	14	19	19	26	30	31	29	21	8	4	211

Table 2 - Number of spray occasions in third worst year of each month for 1971-80: Low Ground Pressure vehicles

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
KINLOSS	0	2	7	6	10	12	16	19	9	8	2	0
TURNHOUSE	0	3	6	9	12	15	15	20	10	11	1	0
ALDERGROVE	1	2	5	14	14	14	16	19	10	11	2	0
ABERPORTH	0	1	2	12	10	14	18	17	11	3	1	0
RHOOSE	1	4	7	14	13	13	19	20	17	10	5	1
MOUNT BATTEN	3	4	6	13	16	17	18	19	17	9	6	2
LEEMING	1	3	5	14	14	17	22	21	11	13	4	0
RINGWAY	1	4	5	9	12	15	20	22	16	14	3	1
SHAWBURY	2	4	6	9	20	16	22	23	15	17	5	1
ELMDON	1	2	6	11	15	18	23	23	17	17	4	1
WADDINGTON	0	1	4	14	12	17	23	25	15	12	2	0
HONINGTON	0	2	5	9	13	16	20	22	16	15	3	0
STANSTED	1	3	5	11	18	20	25	27	21	11	3	1
BOSCOMBE DOWN	1	2	4	8	10	16	17	21	16	9	5	1
GATWICK	2	4	8	15	13	23	23	25	25	18	4	1

Table 3 - Average number of occasions (1971-80) gained in the U.K. by using a Low Ground Pressure Vehicle rather than a conventional vehicle.

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2	6	5	2	1	1	1	2	3	7	4	2

Table 4 - Average number of occasions (1971-80) gained in the U.K. by using a Higher Windspeed sprayer over a Conventional sprayer. (Both systems using Low Ground Pressure vehicles).

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	2	4	7	8	9	9	8	7	6	1	1

Table 5 - Number of spray occasions in 1980-81 when using a Conventional Vehicle

	1980							1981					
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
KINLOSS	11	13	17	2	0	1	0	0	0	6	29	22	
TURNHOUSE	18	28	27	9	7	0	0	0	0	3	27	19	
ALDERGROVE	0	7	15	0	0	0	0	0	0	0			
ABERPORTH	11	11	19	4	2	0	0	0	0	0	22	8	16
RHOOSE	9	17	19	4	0	0	0	0	0	2	14	8	
MOUNT BATTEN	7	15	20	6	5	2	0	0	0	2	16	5	
LEEMING	4	14	19	11	11	2	0	0	0	0	14	10	
RINGWAY	13	19	17	11	3	0	0	0	0	2	22	12	
SHAWBURY	9	22	24	6	1	0	0	0	1	2	23	19	
ELMDON	14	16	23	6	2	0	0	0	1	0	14		
WADDINGTON	17	21	19	14	6	0	0	0	0	0	12	13	17
HONINGTON	20	20	21	16	5	0	0	0	0	0	11	9	
STANSTED	30	26	25	25	5	0	0	0	0	0	12	3	15
BOSCOMBE DOWN	17	13	21	15	5	0	0	0	0	0	12	2	
GATWICK	19	19	31	25	7	0	0	0	0	0	22	12	22

Table 6 - Number of spray occasions in 1980–81 when using a Low Ground Pressure Vehicle

	1980							1981					
	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
KINLOSS	12	18	20	10	6	3	0	1	2	9	29	22	
TURNHOUSE	21	28	27	9	11	1	0	1	1	8	27	19	
ALDERGROVE	5	11	22	10	12	2	0	7	3	11	32	21	16
ABERPORTH	11	12	19	11	2	0	0	3	1	2	22	8	16
RHOOSE	10	18	24	17	10	2	1	6	1	4	14	13	
MOUNT BATTEN	8	15	20	17	9	3	4	10	3	4	16	5	
LEEMING	8	15	25	11	14	3	0	6	2	6	20	10	
RINGWAY	17	20	21	11	11	1	1	3	3	4	25	12	13
SHAWBURY	15	22	26	15	13	3	1	5	2	6	30	19	
ELMDON	18	17	23	11	13	1	0	6	1	2	20		
WADDINGTON	26	24	25	14	12	0	0	3	1	2	17	19	19
HONINGTON	21	20	21	16	10	0	0	5	1	1	15	12	
STANSTED	30	27	25	25	11	2	1	4	1	1	15	11	17
BOSCOMBE DOWN	17	13	23	15	8	3	1	4	2	1	16	3	
GATWICK	25	22	31	25	16	4	1	8	1	4	25	13	24

Table 7 - Number of occasions gained in 1980-81 in U.K. by using a Low Ground Pressure Vehicle rather than a conventional vehicle.

1980							1981				
June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
3	1	2	4	7	1	1	5	1	3	3	2

Table 8 - Number of occasions gained in 1980-81 in U.K. by using a sprayer capable of operating in stronger windspeeds over a conventional sprayer. (Both systems use Low Ground Pressure Vehicles).

1980							1981				
June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May
8	12	7	8	5	1	1	1	1	4	7	10